

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NIPPON SHEET GLASS CO  
LTD

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(72)Inventor : NEMOTO HIROYUKI

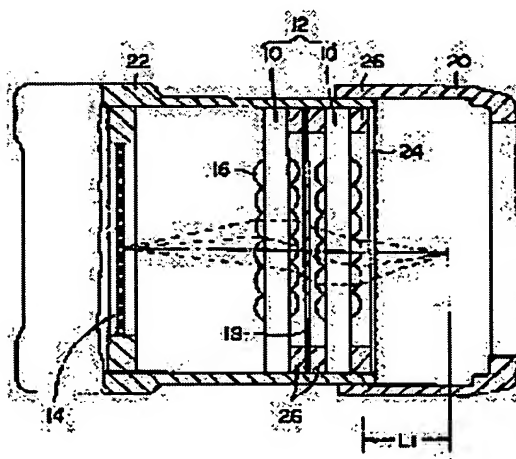
## (54) PICTURE EMBOSSING DISPLAY DEVICE

### (57)Abstract:

PROBLEM TO BE SOLVED: To display an image such as characters, pictures, graphics, and symbols to be emphasized and embossing against a background.

SOLUTION: This device is equipped with an erecting equal magnification real image optical system 12 consisting of two-dimensionally arranged lens plates 10 so that each optical axis of many small lens bodies 16 becomes parallel with each other, and image display elements 14 having a plane form image display screen positioned in the object measurement focus plane of the optical system. The erecting equal magnification real image optical system is

arranged to have an image measurement focus distance of 5 to 100mm, more preferably, 20 to 30mm, and is provided with a background color uniformizing means such a through-hole color plate 18 in the neighborhood of the lens plates as the parts facing each lens body are transparent and the residual parts are colored in a color of a similar shade as that of the background by the image display elements. The object



measurement focus plane of the erecting equal magnification optical system is a vacant space, and entire side planes are shielded by a light-shielding hood so that it includes the position of the image measurement focus plane at least.

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#### CLAIMS

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[Claim(s)]

[Claim 1] The erection actual size real-image optical system which consists of a lens plate which arranged much microlens objects two-dimensional so that the optical axis of each microlens object might become parallel mutually, In the image display device possessing the image display component which is located in the object side focal plane of this erection actual size real-image optical system, and has a plane image display side said erection actual size real-image optical system The image side focal distance is 5-100mm, and the part which counters each microlens object near said lens plate is transparent and colorless. It has a background color equalization means

by which the residual part is colored the background color and affiliated color by said image display component. The image side focal plane serves as an empty field, and the whole side face is surrounded with the protection-from-light hood so that the location of an image side focal plane may be included at least. The image of said image display component according to said erection actual size real-image optical system The image surfacing display characterized by making the image side focal plane location which is the empty field carry out image formation as a space image.

[Claim 2] Erection actual size real-image optical system the lens plate which arranged much microlens objects which consist of the spherical surface, a convex of an aspheric surface configuration, or a concave surface two-dimensional so that the optical axis of each microlens object might become parallel mutually Two or more sheets, The structure which carried out serial arrangement nothing and a background color equalization means The image surfacing display according to claim 1 with which the part which counters each microlens object is opening or a transparent and colorless object, it is the plate-like part material by which the residual part is colored the background color and affiliated color by the image display component, and this background color equalization means is incorporated among lens plates.

[Claim 3] The image surfacing display according to claim 1 with which it consists of a single lens plate which arranged much microlens objects with which erection actual size real-image optical system has refractive-index distribution in radial two-dimensional so that the optical axis of each microlens object might become parallel mutually, and the background color equalization means is formed in the image surface side of a lens plate.

[Claim 4] The erection actual size real-image optical system which consists of a single lens plate which arranged much microlens objects of the shape of a rod which has refractive-index distribution in radial two-dimensional so that the optical axis of each microlens object might become parallel mutually, In the image display device possessing the image display component which is located in the object side focal plane of this erection actual size real-image optical system, and has a plane image display side said erection actual size real-image optical system The image side focal distance is 5-100mm, and this colored resin restoration section serves as a background color equalization means by using for association of each microlens objects the colored resin which colored the background color and affiliated color by said image display component. The image side focal plane serves as an empty field, and the whole side face is surrounded with the protection-from-light hood so that the location of an image side focal plane may be included at least. The image of said image display component according to said erection actual size real-image optical system

The image surfacing display characterized by making the image side focal plane location which is the empty field carry out image formation as a space image.

[Claim 5] The image surfacing display according to claim 1 to 4 which established the dark color system transparency filter means which make it hard to be visible to the image side of said lens plate in the profile of each microlens object of a lens plate.

[Claim 6] The image surfacing display according to claim 1 to 5 which restricted the outgoing radiation angle of said lens plate to less than  $\leq 25$  degrees, and restricted the angle-of-visibility range the space image which carried out image formation appears.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image display device possessing the image display component which has the erection actual size real-image optical system which consists of a lens plate which arranged the microlens object two-dimensional, and the plane image display side located in the object side focal plane. Furthermore, if it states in detail, this invention will have the background color equalization means currently colored the background color and affiliated color by the image display component, and will make an image side focal plane an empty field. Image formation of the images (for example, an alphabetic character, a notation, a picture, a graphic form, etc.) of an image display component is carried out as a space image according to erection actual size real-image optical system, and it is related with the image surfacing display which constituted this space image so that touch with a background might be lost and vision might be carried out by the parallax of both eyes. This equipment is useful to image display devices for the data entry units of a touch loess method which replace a touch panel, such as for example, a play machine and an image display device of a goods display.

[0002]

[Description of the Prior Art] The technique of transmitting the two-dimensional display image information on an image display component according to the optical system using the lens object which has a space image formation operation is

conventionally well-known. In this case, in single optical system, since there is a problem enlarged structurally, the lens plate which made much microlens objects arrange so that the optical axis of each microlens object may become parallel mutually is used. In the optical system using such a lens plate, in order to accumulate the image formation of each microlens object and to compound the overview on the object surface as a reconstruction image on the image surface of a lens plate without conflict, it is necessary to consider as erection actual size real-image optical system.

[0003] While arranging many spherical-surface pillar-shaped lenses as an example of a lens plate so that those opticals axis may become parallel mutually, the configuration which establishes the protection-from-light means for stray light prevention of these mutuals between each spherical-surface pillar-shaped lens is indicated by JP,55-90908,A or JP,1-124801,A. In addition to the function of stray light prevention, said protection-from-light means also has the function which supports many spherical-surface pillar-shaped lenses here. In addition, the example of the lens plate which fabricated much microlens objects of a convex or a concave surface configuration on monotonous so that those opticals axis might become parallel mutually is indicated by JP,55-90908,A, JP,64-88502,A, JP,49-8893,B, JP,61-183601,A, and JP,60-29703,A.

[0004] Moreover, the example of the lens plate which is the refractive-index distribution pattern to which a refractive index changes from the optical axis of each microlens object gradually towards a periphery towards a lens plate front face to the interior of the direction of an optical axis, and was really fabricated on monotonous so that the optical axis of each microlens object might become parallel mutually is indicated by JP,57-53702,A and JP,60-29703,A, without a microlens object being prescribed by the geometric configuration. Furthermore, it uses having the same space image formation operation as the lens usual because the refractive index of an optical fiber changes from a medial axis to parabolic toward a peripheral face as an example of the lens plate of other refractive-index distribution patterns, and several rod-like refractive-index distribution pattern optical fibers [ many ] are bundled, it unifies, and there is a graded refractive index rod lens plate made plate-like by cutting it perpendicularly to shaft orientations.

[0005] Anyway, in the image display device of these space image formation methods, light-scattering plates, such as a screen or ground glass, are arranged in the location of an image side focal plane, and the configuration which projects the image of an image display component on it is taken. Therefore, it will nurse and a person will observe similarly the display image on this light-scattering plate with the usual CRT, a liquid crystal display screen, etc.

[0006] By the way, with these, although there is no direct relation, there is a data entry unit of a touch panel method as a conventional technique. This is equipment displays information required for a panel side, turns a switch on and off by touching this panel side with a finger, chooses required information, and it enabled it to input into a device, for example, is used for the cash dispenser etc. This switch mechanism forms a touch electrode by vapor-depositing metals, such as an indium, to the glass side which displays an image, connects an electronic circuitry to this touch electrode, gives a change of state to an electronic circuitry because people's finger touches a touch electrode, and it has the composition of detecting it. Therefore, the conventional image display device can be used as an object for the data entry units of a touch panel method, if a touch electrode is formed in the light-scattering plate.

[0007]

[Problem(s) to be Solved by the Invention] Although the location distant from the image display component is made to carry out image formation as mentioned above and being sold at the conventional image display technique, since it is what observes the two-dimensional image formed on a light-scattering plate as it is, the superficial vision of the flat-surface image cannot be carried out. Although development is progressing, various three-dimension image display devices it is made to look three-dimensional to it also need an advanced and complicated device, and will become expensive. However, if the simple system which emphasizes an image more and can display it impressively is developed so that it may nurse and a person's attention can be attracted even if it is a two-dimensional image, it will be thought, for example in fields, such as various kinds of play machines, and advertising advertisement, a display for display, that there are many applications.

[0008] By the way, if a data input becomes possible without touching the screen panel instead of a touch panel method, anyone has a dirty feeling but can operate data entry units which many and unspecified men use, such as a cash dispenser and various kinds of ticket machines. Moreover, since contamination by contact on a body (screen panel) does not arise, effectiveness, such as prevention of the hospital infection in a hospital etc., and a panel in various kinds of clean rooms (for example, clean room for biotechnology research etc.), prevention of the contamination expansion through a key, will be expect, and the use range will spread in key input equipment, a data entry unit, etc. which are use by them. For that purpose, although it is not impossible to constitute a data entry unit if a configuration which can shift a switch sensor location and a screen-display location, and serves as another flat surface is adopted even if it uses conventional screen-display equipment, in order to change a directions location with a finger intentionally and to have to operate it to the display position of an image,

puzzlement arises in a data input, and the equipment which is equal to practical use cannot become at all in such an equipment configuration.

[0009] It is offering the image surfacing display which can be displayed that as for the purpose of this invention images (for example, an alphabetic character, a notation, a picture, a graphic form, etc.) were emphasized to the background, have come floating, and appear. Moreover, other purposes of this invention are offering the image surfacing display which does not form a light-scattering plate like a screen in an image formation location, but can carry out vision of the space image as it has come floating as it is so that it can apply to the data entry unit of a touch loess method.

[0010]

[Means for Solving the Problem] The image surfacing display concerning this invention possesses the image display component which has the plane image display side located in the object side focal plane of the erection actual size real-image optical system which consists of a lens plate which arranged much microlens objects two-dimensional so that the optical axis of each microlens object might become parallel mutually, and this erection actual size real-image optical system. And in this invention, said erection actual size real-image optical system has the transparent and colorless part which the image side focal distance was more preferably set as 20-30mm 5-100mm, and has countered each microlens object near said lens plate, and a residual part has the background color equalization means currently colored the background color and affiliated color by said image display component. The color of the part used as the background of the alphabetic character which the image display component displays as the background color by the image display component here, a notation, a picture, a graphic form, etc. is said. The image side focal plane of erection actual size real-image optical system serves as an empty field, and the whole side face is surrounded with the protection-from-light hood so that the location of the image side focal plane may be included at least.

[0011] Image formation of the image of an image display component is carried out to the image side focal plane location which is the empty field as a space image according to said erection actual size real-image optical system. With the conventional technique, the light-scattering plate has been arranged in the location, and the image reflected in it was seen. Therefore, the background color was also reflected in the light-scattering plate, and only the scarce image was able to carry out vision of it to a flat change. However, this invention person used to complete this invention by using the parallax of both eyes paying attention to a space image coming floating and appearing from a background, if there is no light-scattering plate.

[0012] It can fabricate on monotonous or a lens plate can be produced by fabricating a

microlens object in one with a monotonous part so that the optical axis of each microlens object may become parallel mutually about much microlens objects which consist of the spherical surface, a convex of an aspheric surface configuration, or a concave surface. Since such a lens plate can manufacture a minute resin lens by die forming, it is realistic in cost and desirable. Erection actual size real-image optical system can constitute such a lens plate from arranging in two or more sheets and the direction of an optical axis at a serial. In addition, the single lens plate arranged two-dimensional so that many minute rod lenses which have refractive-index distribution in radial might be bundled may constitute erection actual size real-image optical system. Since use of a minute rod lens is a radial refractive-index distribution pattern, its optical-axis adjustment is unnecessary and it has the advantage which can adjust an image formation location with the die length of a rod. In addition, glass is sufficient as a lens ingredient and plastics is sufficient as it.

[0013] By making into an affiliated color the background by the light which passes along a microlens object, and the background by the part without a microlens object, a background color equalization means makes and nurses the condition of \*\*\*\*\* solid color (non-pattern) that the whole background was colored by the almost same color at homogeneity, and achieves the function makes it hard to go to a background and a person's consciousness can be made to carry out vision of the image clearly conversely. The part which counters each microlens object is specifically opening or a transparent and colorless object, and there is plate-like part material which the residual part colored the background color and affiliated color by the image display component. A film, a sheet, etc. are sufficient instead of plate-like part material. The configuration which colors a lens plate in direct coatings depending on the case is also possible. In the case of the lens plate which bundles a rod-like microlens object, it is also possible to color it the background color and affiliated color by the image display component, and to make into a background color equalization means the resin which combines microlens objects. Use a background color equalization means as the colored transparent body, it makes a part of light from an image display component penetrate, and makes a background color from a busy condition into which light hardly goes from the outside. In a busy condition into which light goes from the exterior to some extent, the opaque body (mask) is sufficient as a background color equalization means.

[0014] A protection-from-light hood intercepts space image formation space from a surrounding environment, and bar and nurse the incidence of the outdoor daylight from a side face, it is made for a person's attention to face to a space image as much as possible, and, as for the inside of a protection-from-light hood, also for the reason,



it is desirable that it is a black system. Moreover, it is also effective to form the dark color system transparency filter means which make it hard to be visible in the profile of each microlens object in the field by the side of the image of a lens plate in this invention. In forming a background color equalization means in the image surface side of a lens plate, it forms a dark color system transparency filter means in an image surface side further rather than this background color equalization means. As said dark color system transparency filter means, a smoked filter plate is suitable, for example. The function as for which this dark color system transparency filter means makes it hard to be visible in the profile of a microlens object and which makes a space image much more legible by turning the focus of both eyes to the space image instead of a lens plate front face is achieved. Therefore, the configuration of the coloring matter of a black network dyeing the front face of a lens plate other than the above-mentioned smoked filter plate, or forming by the approach of coating, and sticking the film of a dark color system may be used. As an image display component used by this invention, although a liquid crystal display component is desirable, a flat-surface plasma display panel etc. is sufficient, for example. In addition, an image cannot be overemphasized by that not only a still picture but an animation is contained, and not only a monochrome image but a color picture is contained in this invention.

[0015]

[Embodiment of the Invention] Drawing 1 is the sectional view showing the basic configuration of the image surfacing display concerning this invention. This image surfacing display possesses an image display component 14 like the liquid crystal display component which is located in the object side focal plane of the erection actual size real-image optical system 12 which consists of a lens plate 10, and this erection actual size real-image optical system 12, and has a plane image display side. The lens plate 10 is the configuration of having arranged much microlens objects 16 two-dimensional so that the optical axis of each microlens object might become parallel mutually here. It constitutes combining two double-sided lens plates, and the erection actual size real-image optical system 12 is the image side focal distance  $L1$ . It is set as 20–30mm. Here, between both the lens plates 10, the hole aperture color plate 18 used as a background color equalization means is formed. It is the plate-like part material by which the part to which this hole aperture color plate 18 counters each microlens object 16 of the lens plate 10 became opening, and was colored a residual background color and a residual affiliated color according [ a part ] to the image display component 14. Furthermore, the image side focal plane of the erection actual size real-image optical system 12 serves as an empty field which does not have

light-scattering plates, such as a screen, unlike the conventional technique, and the whole side face is surrounded with the protection-from-light hood 20 so that the location of an image side focal plane may be included at least. It is elastically equipped with this protection-from-light hood 20 to the equipment case 22, and the inside of this protection-from-light hood 20 and the equipment case 22 consists of an ingredient of a black system, or the coating of a black system is applied.

[0016] By the way, the hole aperture color plate 18 which the background color by the image display component 14 is beforehand decided at the time of the design of the equipment, therefore is colored according to the color will be used. For example, if the background color by the image display component is a black system, a hole aperture color plate will also be colored a black system. If the background color by the image display component is the White system, a blue system, or the Green system, a hole aperture color plate will also be colored like the White system, a blue system, or the Green system, respectively. When it is the busy condition into which light goes from the exterior, the hole aperture color plate 18 may be the opaque body (namely, mask). The function in which the hole aperture color plate 18 formed between lens plate 10 comrades prevents the stray light between microoptics systems as it is the opaque body can also be achieved. In being the busy condition into which light does not go from the exterior, the hole aperture color plate 18 is used as the colored transparent body, and makes a predetermined background color using the light from the image display component 14. In addition, the structure where a transparent and colorless object exists instead of opening is sufficient. In that case, the configuration of applying a coating or sticking a color film on the front face of a transparent and colorless glass plate and a transparent and colorless plastic sheet except for the part which counters a microlens object, may be used. As the background color by the image display component 14 which projects the background color by the part without a microlens object with the microlens object 16, and an affiliated color, the whole background by them makes the condition of the \*\*\*\*\* solid color (non-pattern) by which the homogeneity color scheme was carried out in the almost same color, and this background color equalization means forms the background vacantly made into the whole. Furthermore, the smoked filter plate 24 is formed in the image side of the lens plate 10 as a dark color system transparence filter means, and the profile of each microlens object 16 can be gradated. Here, from the object side, arrange so that it may become the sequence of one lens plate 10, the hole aperture color plate 18, the lens plate 10 of another side, and the smoked filter plate 24, and a spacer 26 is made to intervene in between, and it is assembling.

[0017] The lens plate 10 is structure as shown in drawing 2 and drawing 3 here.

Drawing 2 expresses a cross section and drawing 3 expresses a flat surface. To both sides of the transperence plate 28, carry out array formation regularly the shape of an in-every-direction tetragonal lattice, and let much microlens objects 16 of a convex configuration be the lens plates 10 so that those opticals axis may become perpendicular to the transperence plate 28. Such a lens plate is producible by the following approaches, for example. First, substantially, a flat glass substrate is prepared and spherical-surface shaping of the acrylic resin is carried out in parallel using the die which has many spherical-surface configurations on the main front face of one of these. A spherical-surface configuration is arranged in the same pitch in the shape of an in-every-direction tetragonal lattice. Subsequently, according to the alignment mark added to the die, spherical-surface shaping of the acrylic resin is carried out on the main front face of another side of said glass substrate. The core of the spherical lens formed in the front rear face of a glass substrate by this can be arranged with the same shaft. Or the approach of really fabricating a transperence monotonous part and a lens part by acrylic resin may be used.

[0018] since the spherical surface of at least three or more sheets must exist on an optical axis in order to acquire an erection real image, it is shown in drawing 1 — as — the above — the same — or one more above similar lens plate is prepared. For example, the 1st lens side which has the 1st radius of curvature or the 1st aspheric surface multiplier, and the 2nd lens side which has the 2nd radius of curvature or the 2nd aspheric surface multiplier are prepared two pieces, respectively, and it considers as the configuration which arranges said 1st lens side and said 2nd lens side by turns, or the configuration which carries out opposite arrangement of the same lens side. Here, the radius of curvature or aspheric surface multiplier of each spherical surface will be decided with an object side focal location and an image side focal location. It is good to set an object side focal location and an image side focal location to about 20–30mm from the point of the conspicuousness of a surfacing image especially in this invention.

[0019] The principle of operation of the image surfacing display applied to this invention at drawing 4 is shown. The image by the image display component put on the object side focal plane location (location which separated only the object side focal distance  $L_0$  from the lens plate) of the erection actual size real-image optical system 12 connects the space image of erection actual size to an image side focal plane location (location separated from the lens plate only focal distance  $L_1 = 20-30$  mm the image side) according to the erection actual size real-image optical system 12. Therefore, naturally, if a light-scattering plate is in the formation location (image side focal plane location) of the space image, although an image will project, in order to also

project a background color on the same flat surface, a vision \*\*\*\* image will be only a flat mere two-dimensional image. However, since the optical path which results in a right eye differs from the optical path which results in a left eye if the focus of both eyes is doubled with an image formation location as there is no light-scattering plate and it is a mere empty field (space) (if the focus of both eyes suits an image formation location), vision of the space image is carried out by the parallax as what is located in an image side focal plane. In the part of the microlens object which is participating in image formation, the image of an image display component is transmitted as it is. Although a non-lens part (part without a microlens object) is the hole aperture color plate 18, since it is colored the background color and affiliated color by the image display component to it, it will be in the condition of the solid color by which the homogeneity color scheme was carried out in the color almost same as the whole background, and the background which faded as a whole will be formed. For this reason, the focus of both eyes suits the space image located in an image side focal plane, and an image is emphasized to the blurred background, and it will come floating distinctly and will be visible. This is the principle of an image surfacing display.

[0020] By the way, since there is a disposition that a focus (focus) tends to suit a body, if a focus suits human being's eye, it does not get used to the front face of a lens plate and it usually remains as it is, it cannot carry out vision of the space image easily. However, as shown in drawing 1 , it is the image side focal distance L1. When it is set as 20-30mm and a background color equalization means and a protection-from-light hood are prepared especially 5-100mm, a focus becomes easy to suit anyone's space image. Image side focal distance L1 5-100mm, if especially the reason with sufficient setting it as 20-30mm is too short, even if a focus will become easy to suit its lens plate, and a space image will stop being able to be visible easily and it will separate too much conversely, it is because it is hard coming to double a focus with a space image. It makes vision of the space image easy for a background color equalization means to gradate and nurse a background by making the whole background a homogeneity color scheme as mentioned above, and to make it hard to go a person's attention (consciousness), to emphasize an image, and to carry out. Furthermore, a protection-from-light hood isolates a space image from a surrounding environment, and achieves the function which makes it much more legible. Moreover, if a dark color system transparence filter means like a smoked filter plate is established, since the profile of each microlens object will hide and it will become not clear, it nurses on the lens plate itself, a person's consciousness cannot go further easily, and a focus becomes easy to suit a space image.

[0021] Drawing 5 shows the example of a configuration of the image surfacing display

by the lens plate which used the minute rod lens. This image surfacing display possesses an image display component 34 like the liquid crystal display component which is located in the object side focal plane of the erection actual size real-image optical system which consists of a single lens plate 30, and this erection actual size real-image optical system, and has a plane image display side. The lens plate 30 is the configuration of having arranged the microlens object 36 of the shape of a rod of a large number which have refractive-index distribution in radial two-dimensional so that the optical axis of each microlens object might become parallel mutually here. That is, it is the configuration arranged to tabular so that many minute rod lenses might be bundled. Erection actual size real-image optical system is the image side focal distance  $L1$ . It is set as 20–30mm. And the hole aperture color plate 38 was formed in the image side of the lens plate 10 as a background color equalization means, and the smoked filter plate 44 is further formed in the image side as a dark color system transparency filter means. The image side focal plane of erection actual size real-image optical system serves as an empty field without light-scattering plates, such as a screen, and the whole side face is surrounded with the protection-from-light hood 40 so that the location of an image side focal plane may be included at least. The inside is a black system and this protection-from-light hood 40 has it to the equipment case 42. [ elastic ]

[0022] This image surfacing display of the principle the configurations of the lens plate currently used for erection actual size real-image optical system only differ, and an image comes floating and appears is the same as drawing 4 explained. The image by the image display component put on the object side focal plane location (location which separated only the object side focal distance  $L0$  from the lens plate) of erection actual size real-image optical system connects the space image of erection actual size to an image side focal plane location (location separated from the lens plate only focal distance  $L1=20-30$  mm the image side) according to the erection actual size real-image optical system 32. Since the optical path which results in a right eye differs from the optical path which results in a left eye when the focus of both eyes is doubled with an image formation location, with the parallax, vision of the space image would be carried out as what is located in an image side focal plane, the image would be emphasized to the blurred background by the background color equalization means (here hole aperture color plate 38), and it will have come floating, and will be visible.

[0023] When the adhesives (resin) which combine rod-like microlens objects are transparent and colorless, or when [ in order to bundle with means other than adhesives, ] between microlens objects is an opening, it is necessary to form a background color equalization means in the image side face of a lens plate like drawing

5 . However, if the colored resin of a background color and an affiliated color by the image display component is used as adhesives (resin), the restoration section of this colored resin can serve as the function as a background color equalization means. When outdoor daylight can be used, opaque colored resin may be used, but when outdoor daylight cannot be used, a background is formed using a part of light from an image display component using transparent colored resin. The configuration which sticks on the front face of a lens plate the sheet which has a hole aperture or the transparent and colorless section, and a film is sufficient as a background color equalization means, and the configuration which applies a direct coating to a non-lens part is sufficient as it.

[0024] In the image surfacing display of this invention, when the outgoing radiation light from an image display component carries out incidence to a lens plate, it is desirable to restrict the incident angle to the optical axis of said microlens object in a fixed include angle (for example, less than  $45^\circ$ ). This may use the own property (for example, the outgoing radiation angle of a liquid crystal display component is  $45^\circ$  or less degrees) of an image display component, and may establish an incident light limit means independently. The stray light between lenses can be reduced or prevented by this. Moreover, it is desirable to restrict the own outgoing radiation angle of a lens plate to the include angle of the arbitration in a fixed include angle (for example, less than  $25^\circ$ ). The design of a lens plate can perform this. If the own outgoing radiation angle of a lens plate is restricted, the angle-of-visibility range the space image which carried out image formation appears can be restricted, and when others show from the side, it will become a thing suitable for use in a location where security poses a problem.

[0025] Since it is made to sealing structure with a lens plate or a smoked filter plate, out of the equipment case for waterproofing or protection against dust, the image surfacing display concerning this invention can make an image able to emerge, and can be displayed. In that case, although the tip of an equipment case is installed and it is good also as a protection-from-light hood to more than an image side focal plane location, it is desirable to prepare a protection-from-light hood independently so that a part for the point of an equipment case may be covered. Since attachment and detachment of this protection-from-light hood can be enabled, or equipment can be maintained in a compact when elastic, then unnecessary, it becomes a more desirable configuration.

[0026]

[Example] The example of a design of erection actual size real-image optical system is shown in drawing 6 and Table 1. The configuration of erection actual size real-image

optical system arranges the two same lens plates symmetrically here. Both the lens plate really fabricates a monotonous part and the spherical-lens part of both the main front face by transparent and colorless acrylic resin using a die. It sets to drawing 6 and is  $r_1 - r_4$ . It is the radius of curvature of four microlens objects, respectively, and is referred to as  $r_1$ ,  $r_2$ ,  $r_3$ , and  $r_4$  from an object side at order. When radius of curvature is negative, the spherical surface means that it is a convex in the image side. Since it is symmetry mold arrangement, the radius of curvature of a microlens object is  $r_1 = -r_4$  and  $r_2 = -r_3$ . It becomes.  $n$  is the refractive index of the acrylic resin which constitutes the lens plate.  $L_0$  is the distance of an object side focus and the lens side of a microlens object nearest to an object side, and  $L_1$ . The distance of an image side focus and the lens side of a microlens object nearest to an image side, and  $L_2$  It is opposite spacing of two lens plates.  $d_1$   $d_2$  The thickness of a lens plate, and  $\phi_1$   $\phi_2$  It is the aperture of each microlens object. It is  $L_0$ ,  $L_1$ ,  $L_2$ ,  $d_1$ , and  $d_2$  here. Each is the die length on an optical axis. In addition, all of the unit of these die length are mm. [0027] Table 1 lists whenever [ said optical-system, dimension / of a lens /, and lap / of a space image /  $m$  ], ( $m = \text{image quantity} / 2 \times \text{lens radius}$ ), and spatial frequency  $w$  ( $L_p / \text{mm} / 20\%$ ) about nine examples of a configuration.  $m$  is a value meaning the lap condition at the time of defining as the visual field radius of the image which the lens makes to the diameter of a lens, and forming a synthetic image whenever [ lap ]. In order to accumulate the image formation of each microoptics system and to compound a reconstruction image, it needs that  $m$  is one or more whenever [ lap ]. Although spatial frequency  $w$  is a numeric value corresponding to resolution and it is shown that  $w$  is so high that the value is large, there is especially no numerical limit, and it is designed so that it may have a suitable value according to an application. [0028]

[Table 1]

構成例	例 1	例 2	例 3	例 4	例 5	例 6	例 7	例 8	例 9
$r_1$	0.68	0.548	0.517	0.688	0.54	0.52	0.592	0.543	0.523
$r_2$	-0.686	-0.523	-0.47	-0.686	-0.509	-0.47	-0.572	-0.509	-0.47
$r_3$	0.686	0.523	0.47	0.686	0.509	0.47	0.572	0.509	0.47
$r_4$	-0.68	-0.548	-0.517	-0.688	-0.54	-0.52	-0.592	-0.543	-0.523
$L_0$	20	20	20	25	25	25	30	30	30
$L_1$	20	20	20	25	25	25	30	30	30
$L_2$	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
$\phi_1$	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
$\phi_2$	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
$d_1$	2.051	1.564	1.267	2.051	1.52	1.267	1.709	1.52	1.267
$d_2$	2.051	1.564	1.267	2.051	1.52	1.267	1.709	1.52	1.267
$n$	1.503	1.503	1.503	1.503	1.503	1.503	1.503	1.503	1.503
重なり 度 $m$	7.1	9.5	12.1	8.8	11.9	15.2	10.6	14.3	18.2
空間周 波数 $w$	2	1.2	0.7	1.8	0.8	0.4	1.2	0.7	0.4

[0029] By the lens plate manufactured based on such a concrete numeric value, it is the image side focal distance  $L_1$ . The erection actual size real-image optical system which is 20–30mm can be constituted, and it can constitute the image surfacing display of this invention. Moreover, the angle of visibility of a space image can be chosen as arbitration by lens design.

[0030] In the above-mentioned table 1, although it differs, even if it arranges two lens plates to the same direction (namely,  $r_1 = r_3$  and  $r_2 = r_4$ ), it is the image side focal distance  $L_1$ . The erection actual size real-image optical system which is 20–30mm can be constituted. When it is such a lens plate array, they are the object side focal distance  $L_0$  and the image side focal distance  $L_1$ . It can be made to differ and the advantage that constraint of an installation location is lost arises.

[0031] When the lens plate which consists of a microlens object of a rod-like radial refractive-index distribution pattern is used, erection actual size real-image optical



system can consist of one lens plate. When a focal distance (distance from a lens end face to an image surface side focal plane) is 20mm, a lens diameter is more preferably good to be referred to as about 0.1–0.6mm 0.05–1.0mm. Moreover, when a focal distance is 30mm, it is good to set a lens diameter to about 0.1–0.8mm more preferably 0.05–1.2mm. It is because the profile of a microlens object becomes clear, so a space image will be hard coming it reverse to look if the diameter of a lens becomes large.

[0032] The application to the touch loess switch of such an image surfacing indicating equipment is shown in drawing 7 . Since the basic configuration of an image surfacing display may be the same as that of drawing 1 , in order to simplify explanation, the same sign is given to a member. This equipment possesses the erection actual size real-image optical system 12 which used two lens plates 10, and the liquid crystal display component 14 prepared in the object side focal location. The lens plate 10 may really fabricate the thing which fabricated many spherical lenses by acrylic resin to both sides of a glass substrate which was explained by drawing 2 and drawing 3 , or a monotonous part and a lens part by acrylic resin here. Between both the lens plates 10, the part which counters each microlens object 16 is opening 17, and a residual part forms the hole aperture color plate 18 colored the background color and affiliated color by the image display component 14. Moreover, the smoked filter plate 24 (in order to make a drawing intelligible, a part is fractured and it has drawn) as a dark color system transparence filter means is formed in the image side of the erection actual size real-image optical system 12. A switch sensor is formed in such a circumference flank of the upper image side focal plane (space image formation side) location of an image surfacing indicating equipment. This switch sensor is provided so that pair [ every ] phase opposite of the light-emitting part 52 which arranged two or more light emitting devices 50, and the light sensing portion 56 which arranged two or more photo detectors 54 may be carried out, respectively in a lengthwise direction (the direction of Y), and a longitudinal direction (the direction of X). And it is constituted so that the light from each light emitting device may be received by the photo detector which counters it. A light emitting device and a photo detector are located in the level of an image side focal plane about the vertical direction, and they are prepared so that it may be related horizontally and may correspond to each space image. In addition, in drawing 7 , on the relation of illustration, although one side of a light-emitting part and one side of a light sensing portion have excluded, they are installed so that the light sensing portion and light-emitting part which are illustrated may be countered in fact, respectively. These light-emitting parts and light sensing portions can use for example, a protection-from-light hood, and can also assemble it

by attaching in the internal surface.

[0033] The image of the liquid crystal display component 14 forms the space image 58 according to the erection actual size real-image optical system 12. As it was emphasized from the background carried out vacantly and came floating, vision of the space image 58 is carried out by the parallax of both eyes. And the beam of light passes from the light emitting device to the photo detector along the image side focal plane in which the space image is formed (a broken line shows a beam of light). Therefore, if a finger 59 is inserted in the location of the target space image, it will be sensed by the corresponding photo detector that the beam of light was interrupted and shaded with the finger 59. The location (XY coordinate) of the inserted finger can be detected by change of the light-receiving condition of the light-receiving element array of the direction of X, and the light-receiving element array of the direction of Y, and a switch operates as what pointed to the image of the location by it. Since a switch operates by a beam of light being interrupted, even if it is not a finger and another bodies (for example, shaft of writing materials etc.) are inserted, it will operate as a switch similarly.

[0034] Drawing 8 shows other applications to the touch loess switch of the image surfacing indicating equipment concerning this invention. Since the basic configuration of an image surfacing display is the same as that of drawing 5 , in order to simplify explanation, the same sign is given to a member. This equipment possesses the erection actual size real-image optical system which consists of a single lens plate 30, and the liquid crystal display component 34 prepared in the object side focal location. The lens plate 30 is the configuration which arranged many radial graded refractive index rod lenses two-dimensional, and combined the microlens objects by resin (adhesives) here. The hole aperture color plate 38 used as a background color equalization means is formed in the image side face, and the smoked filter plate 44 as a dark color system transperence filter means is further formed in the image side face. A switch sensor is formed in the perimeter side face near [ upper ] the image surface side focal plane of such an image surfacing indicating equipment. This switch sensor is the same as that of said example ( drawing 7 ), makes a pair the light-emitting part 62 which put two or more light emitting devices 60 in order, and the light sensing portion 66 which put two or more photo detectors 64 in order the side which carries out phase opposite in a side face, and has prepared it in the lengthwise direction (the direction of Y), and the longitudinal direction (the direction of X), respectively. Although not shown in drawing 8 , the light-emitting part is formed also in the near side.

[0035] The image of the liquid crystal display component 34 forms a space image in

the location of a switch sensor according to the erection actual size real-image optical system by the lens plate 30. As he was clearly conscious and touch with the background of the absent-minded solid color by the background color equalization means was lost, vision of the space image is carried out by the parallax of both eyes. Therefore, if a body (for example, finger) is fitted over the location of the target space image, the beam of light from a light emitting device will be interrupted by it, and it will be sensed by the photo detector. The inserted location (XY coordinate) can be detected by change of the light-receiving condition of the photo detector arranged in the direction of X, and the photo detector arranged in the direction of Y, and a switch operates as what pointed to the image of the location by it.

[0036] The configuration of a switch sensor is not restricted to the above-mentioned example. What is necessary is just to be able to pinpoint quickly the location of the body (finger) put on space in a certain amount of precision.

[0037]

[Effect of the Invention] The erection actual size real-image optical system which this invention becomes from a lens plate as mentioned above, The image display component which has the plane image display side located in the object side focal plane is provided. Since it is the image surfacing display with which an image side focal distance is set as 5-100mm, it has a background color equalization means, and the image side focal plane serves as an empty field, in spite of being a simple configuration \*\* to which vision of the images, such as a pictorial symbol of an image display component, is carried out as a space image which emphasized and came floating to the background of the solid color by which the homogeneity color scheme was carried out is made. Impressive image display which nurses in a play machine, various kinds of advertising advertisement or displays for display, etc., and attracts a person's attention by it can be made to perform.

[0038] Moreover, it is effective in the image display in a location where there is no light-scattering plate etc., the angle-of-visibility range a space image appears when the outgoing radiation angle of a lens plate is restricted, since it is the space image which carries out vision using the parallax of both eyes can be restricted, a fear of others' show from the side disappears, and especially security poses a problem.

[0039] Furthermore, since an image comes floating and looks above, the image surfacing display of this invention is combining with the sensor which detects existence of an object and un-existing, and is useful to the image display device of the data entry unit of a touch loess method. That is, since a non-contact switch sensor location and a non-contact screen-display location can be constituted so that it may become the same flat surface, puzzlement is not produced in a data input that what is

necessary is just to direct the operating space of an image with a finger. Since a data input becomes possible by this without contacting a screen panel, data entry units which many and unspecified men use, such as a cash dispenser and various kinds of ticket machines, can be operated without anyone's producing a dirty feeling. Moreover, since contamination by contact on bodies (screen panel etc.) does not arise, effectiveness, such as prevention of the hospital infection in a hospital etc., and a panel in various kinds of clean rooms (for example, clean room for biotechnology research etc.), prevention of the contamination expansion through a key, can be expected, and the use range will spread in key input equipment, a data entry unit, etc. which are used by them.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] The sectional view showing one example of the image surfacing display concerning this invention.

[Drawing 2] The sectional view showing an example of the lens plate built into it.

[Drawing 3] The part plan of the lens plate.

[Drawing 4] The explanatory view of the principle of operation of the image surfacing display concerning this invention.

[Drawing 5] The sectional view showing other examples of the image surfacing display concerning this invention.

[Drawing 6] The optical system of a lens plate, and the dimension explanatory view of a lens.

[Drawing 7] The partial perspective view showing one example of the touch loess switching equipment adapting this invention.

[Drawing 8] The sectional view showing other examples of the touch loess switching equipment adapting this invention.

### [Description of Notations]

10 Lens Plate

12 Erection Actual Size Real-Image Optical System

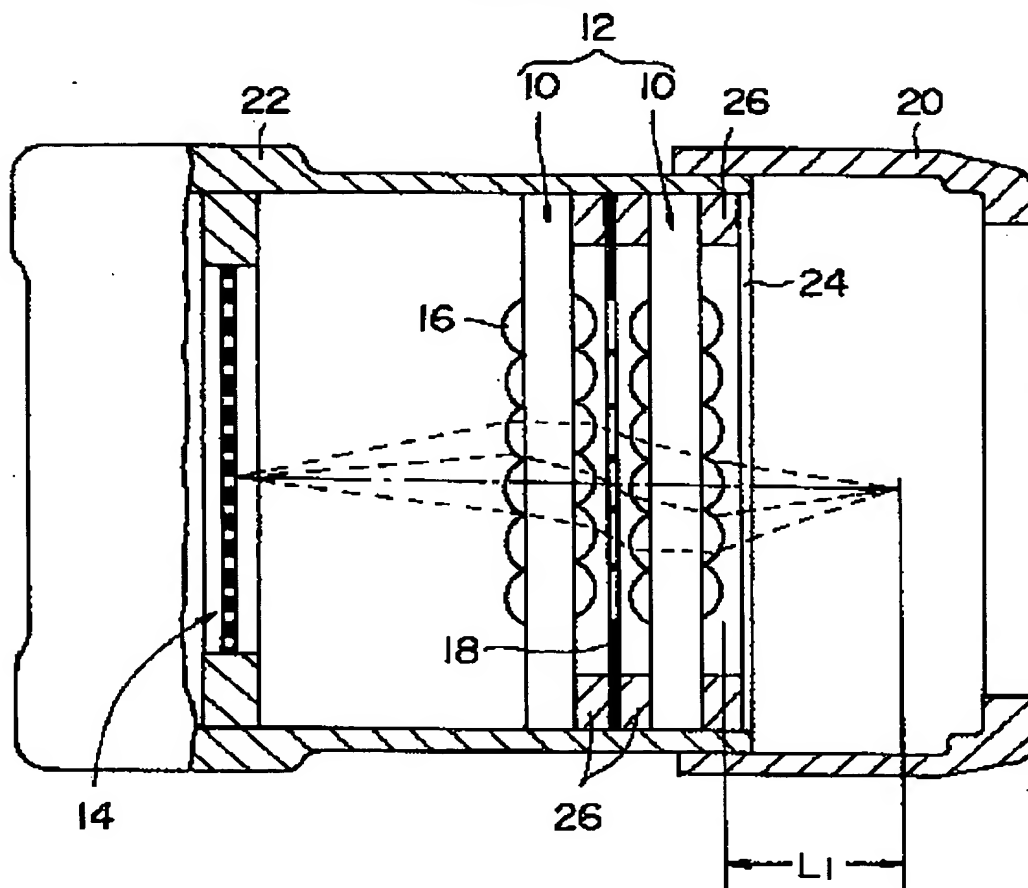
14 Image Display Component

16 Microlens Object

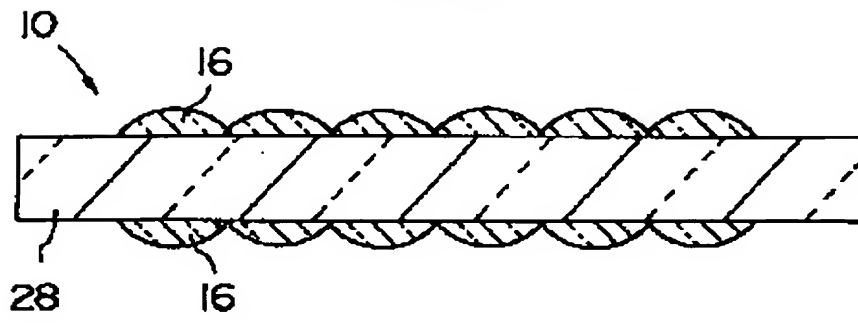
18 Hole Aperture Color Plate

## 26 Spacer

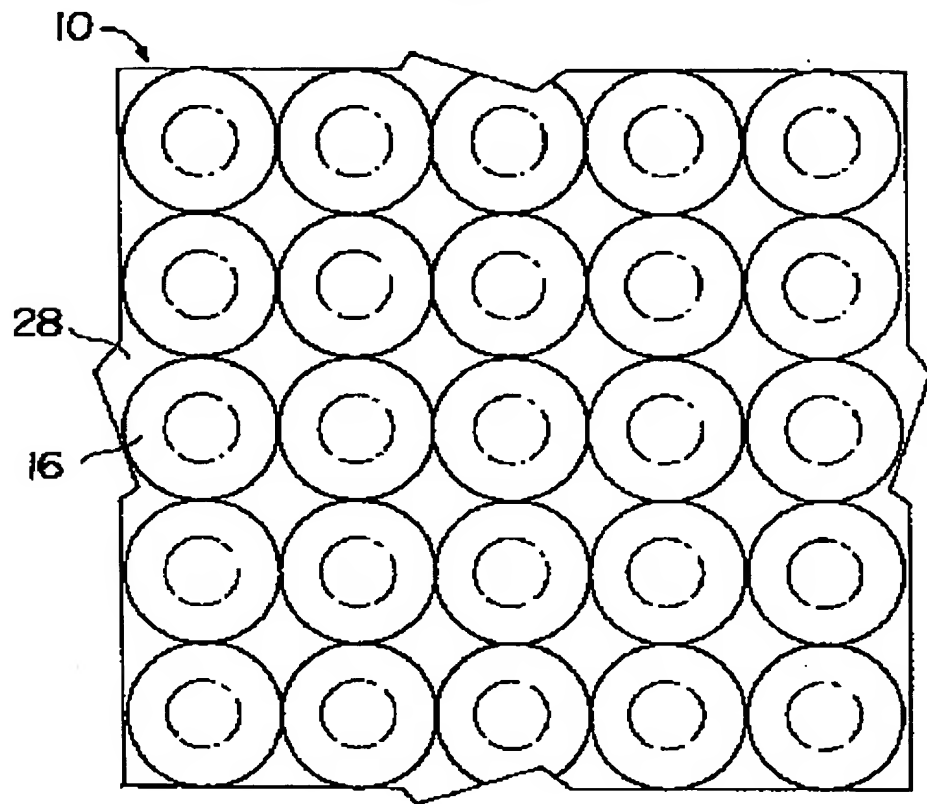
[Drawing 1]



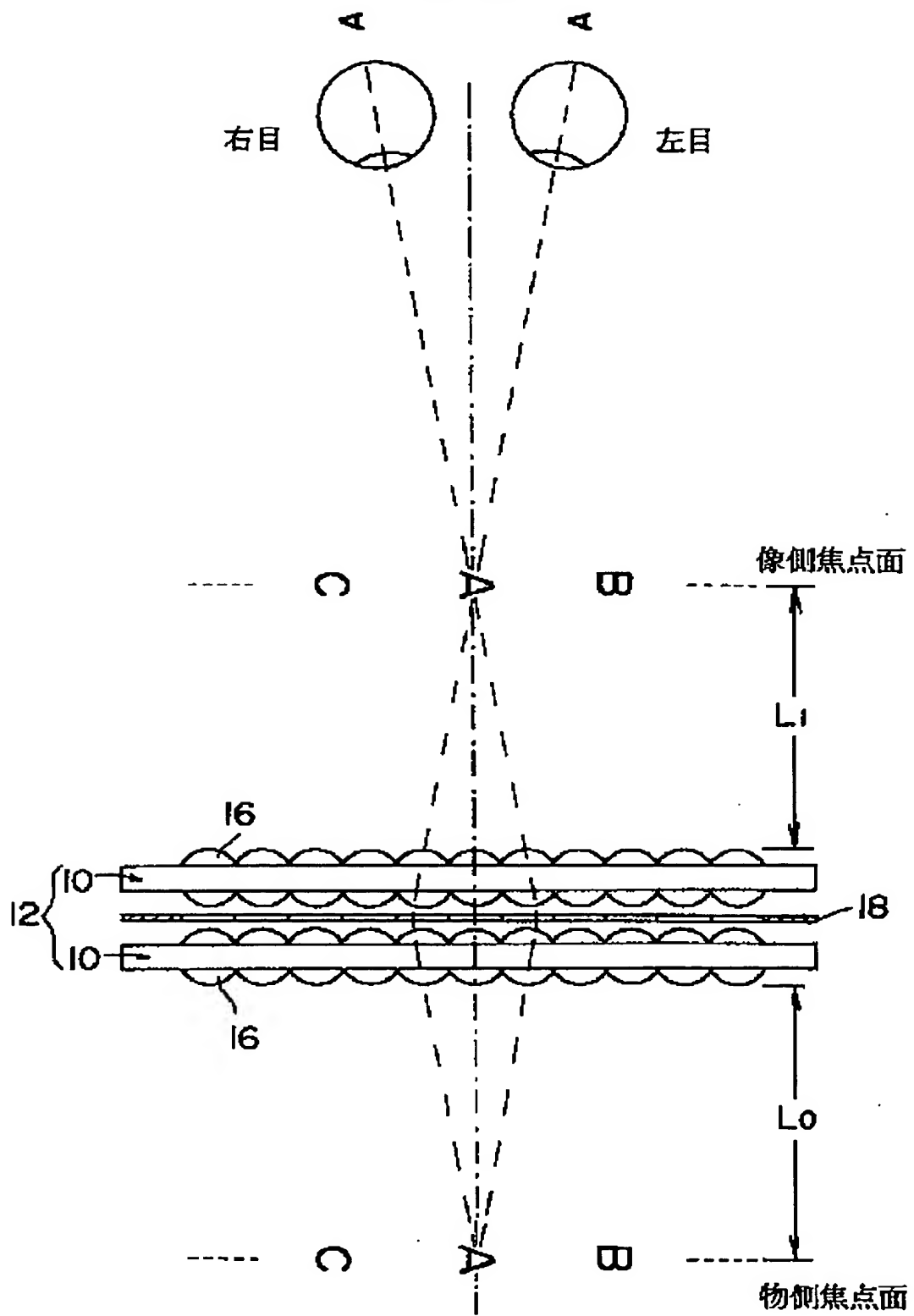
[Drawing 2]



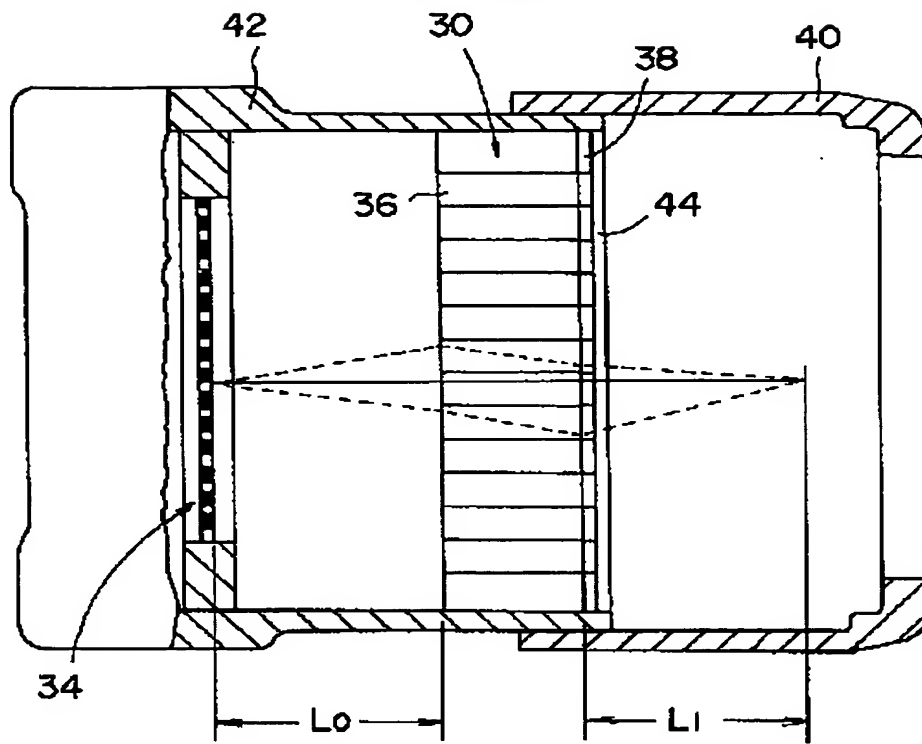
[Drawing 3]



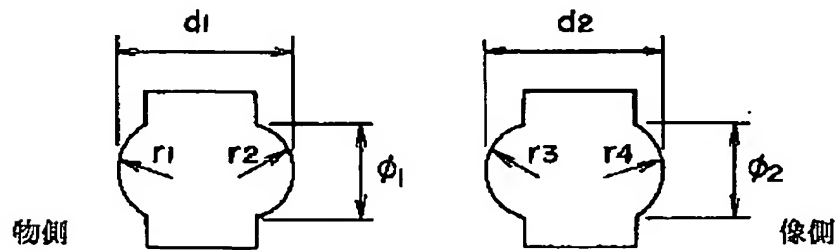
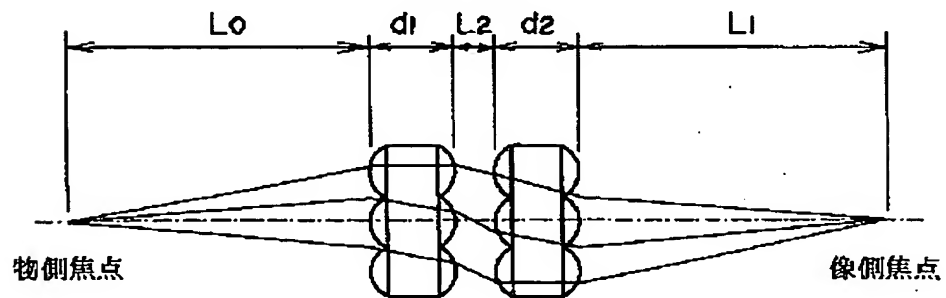
[Drawing 4]



[Drawing 5]

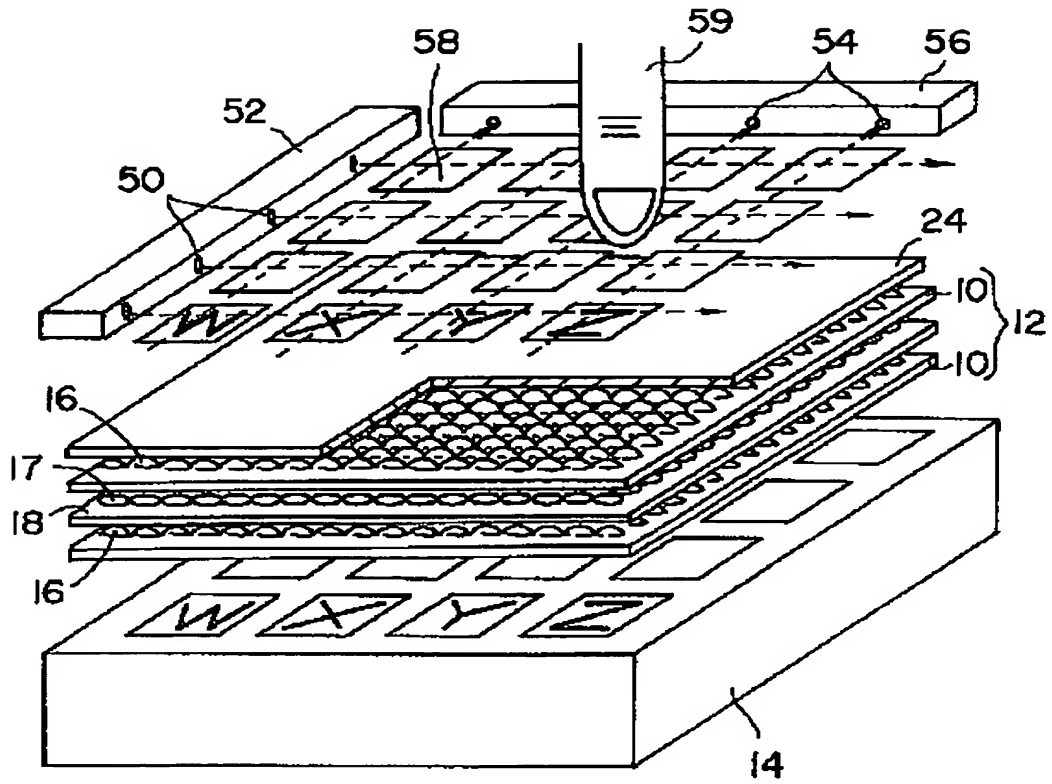


[Drawing 6]

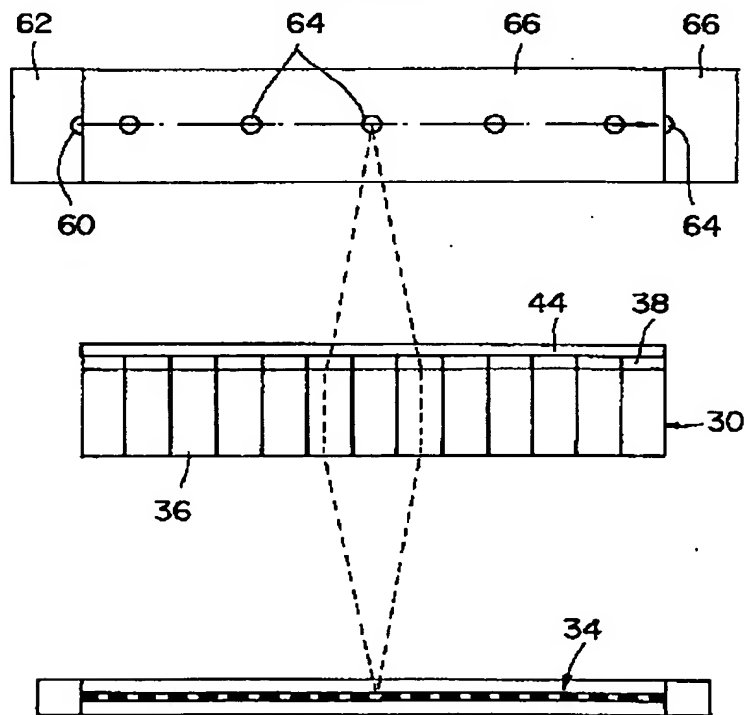




[Drawing 7]



[Drawing 8]



キャビティのコーナ部より下になることから、本願発明のように前記コーナ部を包み込むような構成とはなり得ず、本願発明の前記作用・機能が得られないものである。

(3) よって、本願発明が「高く」構成したものであるのに対し、引用例では「低く」構成されている点で、本願発明と引用例とは、弾性プライマー層の構成は全く逆であり、課題解決手段、および、その作用、機能においても顕著に相違していることから、全く異なる技術的思想に立脚するものである。その上、引用例には、本願発明に対し動機付けとなり得る記載も示唆もなく、引用例から本願発明が容易に想到し得たと認めることはできない。

(4) 次に、本願発明は、引用例 1 に対し、単なる設計変更該当しない旨を以下に主張する。

確かに、型締め力による圧縮力をより高めるためには、金型の当接する部分の高さを変化させること等は、当業者が通常行ない得るところである。

したがって、本願発明が弾性プライマー層の高さを高くしたのが、型締め力による圧縮力を高めるためであれば、上記見解も承服できる。

しかし、型締め力による圧縮力を高めるためではなく、全く異なる技術思想に基づき、弾性プライマー層の「高さの差」を設けたものである場合は、単なる設計変更と認めるべきではない。

この点、本願発明について考察すると、「金型が当接する部分の高さを当接しない部分より高く」したのは、前記のように、コーナ部とパーティングラインとを隔離させるためであり、型締め力による圧縮力を高めることとは、全く異なる技術思想に基づくものである。

しかも、弾性プライマーのように金型に塗布するものについて、その一部分だけを高くするようなことが、通常行なわれているという事実は存在しない。

よって、本願発明に係る「弾性プライマー層の高さの差」を設けることは、単なる設計変更ということとはできない。

(5) 以上より、本願発明は、特許法第 29 条第 2 項の規定により特許を受けることができないとの見解は採用されるべきではない。

### 3. 請求項 2 に係る発明について

請求項 2 に係る発明は、請求項 1 に従属されていることから、請求項 1 の進歩性が肯定されるべきである以上、当然に、請求項 2 に係る発明についても進歩性が肯定される。

なお、請求項 2 に係る発明については、必要な型締め力を必要な箇所効率よく作用させるという技術思想に立脚しているものである点で、引用例とは顕著に相違するものである。

### 4. 結び

以上の次第でありますから、本願は拒絶理由に該当するものではないと確信致しますので、特許査定を賜りますよう、再度御審査の程宜しくお願い申し上げます。